New Means for Automatic Testing and Control in Non-ferrous Metallurgy

(Figure 3). For the continuous analysis of hydro-metallurgical solutions, the KB TsMA in 1957 developed (Figure 4) an automatic polarographic concentration-meter, type KAP-225, with a transducer type DAPK-226: this device has been successfully used at the "Elektrotsink" Works for analysing for cadmium in zinc electrolyte and is based on alternating-current polarography. The KB TsMA have developed a series of radioactive methods, particularly for level indication over a wide (type URP) (Figure 5) and a relatively narrow (type URPR) (Figure 6) range. A radioactive density-meter, type PR-150, independent of the mineralogical and size composition of pulp over a wide range has been successfully tested at the Zolotushinskaya obogatitel'naya fabrika (Zolotushinskaya Beneficiation Works) (ranges 1.5-2.5 and 1-2 kg/litre). Work is proceeding on other radioactive meters including a moisture meter, for concentrates and similar materials. Based on corrosion-resistant, differential, thermo-electric anemometer (electrical circuit proposed by engineers V.A. Drozdov and A.M. Listov), a flowmeter for pure or air-diluted chlorine has been developed by the

New Means for Automatic Testing and Control in Non-ferrous Metallurgy

KB TsMA; they have also developed an analyser (type GAKh-239) for chlorine which is accurate to ± 3% and these two instruments are to be used in an integrated automation system being devised for the magnesium industry. The KB TsMA have developed an automatic installation for (Figures 7 and 8) controlling a single pump in relation to the liquid level. Another recent activity of this organisation has been the development of the type ATV-229 overheating protective device (Figure 9) and a twelve-point temperature signalling device (Figure 10). The ATV-229 device is to be produced by the Tsvetmetpribor Works. In collaboration with the Institut gigiyeny truda i profzabolevaniy AMN SSSR (Institute of Work Hygiene and Occupational Diseases of the AMS USSR), the KB TsMA have developed a device (Figure 11) for continuous measurement and recording of mercury-vapour concentration in air in the range 0.1 - 0.6 mg/m^3 . This instrument (IKRP-445) (Figure 11) also gives an alarm signal if the concentration becomes excessive and its range is being extended in both directions.

SOV/136-58-6-8/24

AUTHORS: Feygin, V.I. and Zhiryakov, N.I., Boguslavskiy, I.M.

TITLE: Automation of Rolling Mills in Non-ferrous Metallurgy (Avtomatizatsiya prokatnykh stanov v tsvetnoy metallurgii)

PERIODICAL: Tsvetnyye Metally, 1958, Nr 6, pp 42 - 52 (USSR)

ABSTRACT: This article deals mainly with work done by the KB Tsvetmetavtomatika on the automation of the three-high, hot-rolling mill at the imeni S. Ordzhonikidze Works and of the reversing cold strip mill at the Kirovskiy zavod (Kirov Works). The work on the first was carried out with the participation of B.S. Fradkin, V.S. Morozov and A.A. Vasil'yeva. This mill rolls mainly billets of type L-62 (115 x 800 x 600 mm) and L-90 (100 x 800 x 350 mm) brass into coiled strip (4.0 - 6.0 mm thick) or sheet (15 mm thick), generally in nine passes. The first stage of automation embraces all the operations, previously carried out by the operator, all the roller tables, the tilting lifts, the middle-roll moving mechanism and the screw-down to a programme, synchronization of the roller speeds with that of the rolled strip to avoid surface damage. The operator now merely selects the appropriate programme and looks after the mechanisms; the arrangement (Figure 3)

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does provide for immediate manual take-over. The authors describe the system in detail and state that experience has shown that the automation had led to some process advantages and a 2% increase in rolling rate; the power of the motor preventing further improvements; almost all occasions of manual take-over were due to outside factors; the scatter in the thickness of the product was 35% less than with manual control. The automation of cold-rolling mills was started at the end of 1956. With the participation of B.M. Avdeyev and S.I. Alimov, the 250 four-high mill for cold-rolling brass from 1 to 0.4 mm at rolling speeds up to 3.5 m/sec has been automated, some original (Ref 4) proposals as well as some made by the TsKB "Elektroprivod" (Ref 5) and TsNIITMash (Ref 6) being used. For the continuous measurement of metal pressure on the rolls, a strip strain gauge (Figure 4) is used, provision being made for calibration directly in the mill, according to a proposal by Ye.S. Rokotyan and I.M. Meyerovich of TsKBMM of TsNIITMash. When the pointer on the indicating instrument reaches the maximal desired value of the pressure, it operates a photo-relay to produce the appropriate change

at the stand. For the continuous thickness control of the strip, the system adopted (Figure 5) is based on two radioactive isotope devices, one before and the other after the mill. An integrating device (Figure 6) is included in the system to ensure that only sufficiently important changes in thickness operate the control system. For stopping the rolls just before the end of the strip reaches them, a system (Figure 7) based on counters of the number of turns of strip on the coilers is used; for thicker strip (0.7 mm and over) the metal is allowed to leave the coilers but not the rolls, the control being effected with the aid of a small, type FR-236 photo-relay (Figure 8). In 1957, the KB TsMA studied the indirect measurement of roll temperature from that of a small volume of air in contact with the rolls. Model tests have shown an error of $\pm 3^{\circ}$C for an ambient temperature of $20 \pm 5^{\circ}$C.

Automation of Rolling Mills in Non-ferrous Metallurgy

There are 8 figures and 6 Soviet references.

ASSOCIATION: KB Tsvetmetavtomatika

Card 4/4

14(5)

SOV/127-59-3-9/22

AUTHOR: Zhiryakov, N.I., Engineer

TITLE: Comprehensive Installation for the Automation of a Number of Single Pumps (Komplektnaya ustanovka avtomatizatsii odinochnykh nasosov)

PERIODICAL: Gornyy zhurnal, 1959, Nr 3, pp 33-36 (USSR)

ABSTRACT: The Design Office of Tsvetmetavtomatika has developed the AIN-62 simplified comprehensive installations for the automation of single pumps. The devices are operated by 50-60 kw asynchronic motors with a short circuited rotor. When a pumping station is being automated, each pump is equipped with such a unit with DU-1007 level indicators installed to ensure a desired alternating switch-in of pumps. The AIN-62 (figure 2) is composed of a hermetical control box (figure 1) and a contact transmitter of impulses for switching the pumps on or off. As desired, it can contain an RZN-67 relay (controlling the filling up of pumps

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Comprehensive Installation for the Automation of a Number of Single Pumps.

when the water level in the reservoir is lower than the pump axle), RD-70 or RD-75 relays (controlling the pressure in the delivery conduit, when this pressure is more than 1.5 atm), or an RU-16 regulator of water level in the pouring basin with an RZN-68 water level control relay in the pouring basin in all cases of the filling-in of pumps from a pouring basin. A detailed description of the operation of the AIN-62 is given. All the above devices are being serially produced by the Tsvetmetpribor Plant. The AIN-62 installations are especially designed for mines, concentration plants and hydro-metallurgical shops where the humidity is very high (up to

Comprehensive Installation for the Automation of a Number of Single Pumps.

90%). They are fed from a single-phase a.c. net of 320 or 220 v. The installations are now in the Degtyarka copper mine and in the Tyrny-Auz Combine. There is 1 photo and 1 scheme.

ASSOCIATION: Tsvetmetavtomatika, Moscow

BOGULAVSKIY, I.M.; ZHIRYAKOV, N.I.; FEYGIN, V.I.

Automation of a reversing mill for cold rolling of nonferrous metals. Sbor.mat.po avtom.proizv.prots.i disp. no.5:72-93 '60. (MIRA 14:4)

1. Konstruktorskoye byuro "TSvetmetavtomatika." (Rolling mills) (Automation)

ZHIRYAKOV, Viktor Georgiyevich; YERSHOV, V.V., red.; SHPAK, Ye.G., tekhn. red.

[Organic chemistry] Organicheskaia khimiia. Moskva, Gos. nauchno-tekhn. izd-vo khim. lit-ry, 1961. 380 p. (MIRA 15:1)

(Chemistry, Organic)

ZHIRYAKOV, Viktor Georgiyevich; ROMM, R.S., red.

[Organic chemistry] Organicheskaia khimiia. Moskva, Khimiia, 1965. 423 p. (MIRA 18:9)

ZHIRYAKOV, V. G.

ZHIRYAKOV, V. G. -- "Synthesis and Investigation of Certain New Merocyanine Dyes With Substituents in the External Polymethine Chain." Sub 13 Nov 52, All-Union Sci Res Cinephotographic Inst (NIKFI) (Dissertation for the Degree of Candidate in Chemical Sciences).

SO: Vechernaya Moskva January-December 1952

ZHIRYAKOV, V. G.

USSR/Chemistry

Card 1/1

Authors : Zhiryakov, V. G.; and Levkoyev, I. I.

Title : Color of certain merocynaine dyes-derivatives of indandione-1, 3.

Periodical : Zhur. Ob. Khim. 24, Ed. 4, 710-717, April 1954

Abstract : Synthesized were certain di-, tetra- and hexamethinemerocyanines-derivatives of indandione-1, 3 and corresponding tri- and pentamethinor anines. Investigated were [illegible] in mixtures [illegible] the polymethine chromophore and [illegible] on reference see. 2 USSR since 1940; 4 German since [illegible]; 4 English since 1933. Tables.

Institution : All-Union Scientific-Research Motion Picture-Photo Institute

Submitted : November 10, 1953

AUTHORS: Zhiryakov, V. G., Levkoyev, I. I. SOV/20-120-5-29/67

TITLE: The Synthesis of 2-Methyl-4,5-Thiophene (2',3') Thiazole (Sintez 2-metil-4,5-tiofeno (2',3')tiazola)

PERIODICAL: Doklady Akademii nauk SSSR, Vol. 120, Nr 5, pp. 1035 - 1037 (USSR)

ABSTRACT: The isosterism of the groups -CH=CH- and -S- is well known for the thiazole- and pyridine derivatives. It was very interesting to observe the degree of isosterism of these groups in the series of the benzthiazole- and thiophene-thiazole which have a heterocyclic basis with condensed rings of thiazole and thiophene. In order to obtain the substance mentioned in the title the thioacetyl derivative of the α-aminothiophene which was then oxidized by means of iron-ferricyanide was used as a starting point. The first attempts of a synthesis of the substance in question failed. A crystalline disulfide with a melting point of 107-108° (I) was formed. The substance in question was obtained with a yield of 10% of the theoretically possible beside the mentioned disulfide only after the addition of the 2-thioacetyl-amino-thiophene solution in a NaOH aqueous solution to a diluted iron ferricyanide solution. The obtained base is a colorless oil which gradually

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The Synthesis of 2-Methyl-4,5-Thiophene (2',3') Thiazole SOV/2o-12o-5-29/67

turns yellow. It has a boiling point of 1o2 - 1o4° /7 mm with the characteristic smell of the quinoline bases. It forms easily a picrate, iodine methylate, and ethylate. Table 1 shows that several constants of the 2-methyl-4,5-thiophene (2',3') thiazole and of the 2-methyl benzthiazole as well as of their derivatives are rather similar. There are 1 table and 9 references, 2 of which are Soviet.

ASSOCIATION: Vsesoyuznyy nauchno-issledovatel'skiy kino-foto-institut (All Union Scientific Research Institute of Photography and Cinematography)

PRESENTED: February 6, 1958, by I.L.Knunyants, Member, Academy of Sciences, USSR

SUBMITTED: January 30, 1958

1. Benzthiazole--Synthesis 2. Thiophene--Synthesis 3. Sulfur compounds--Properties

Card 2/2

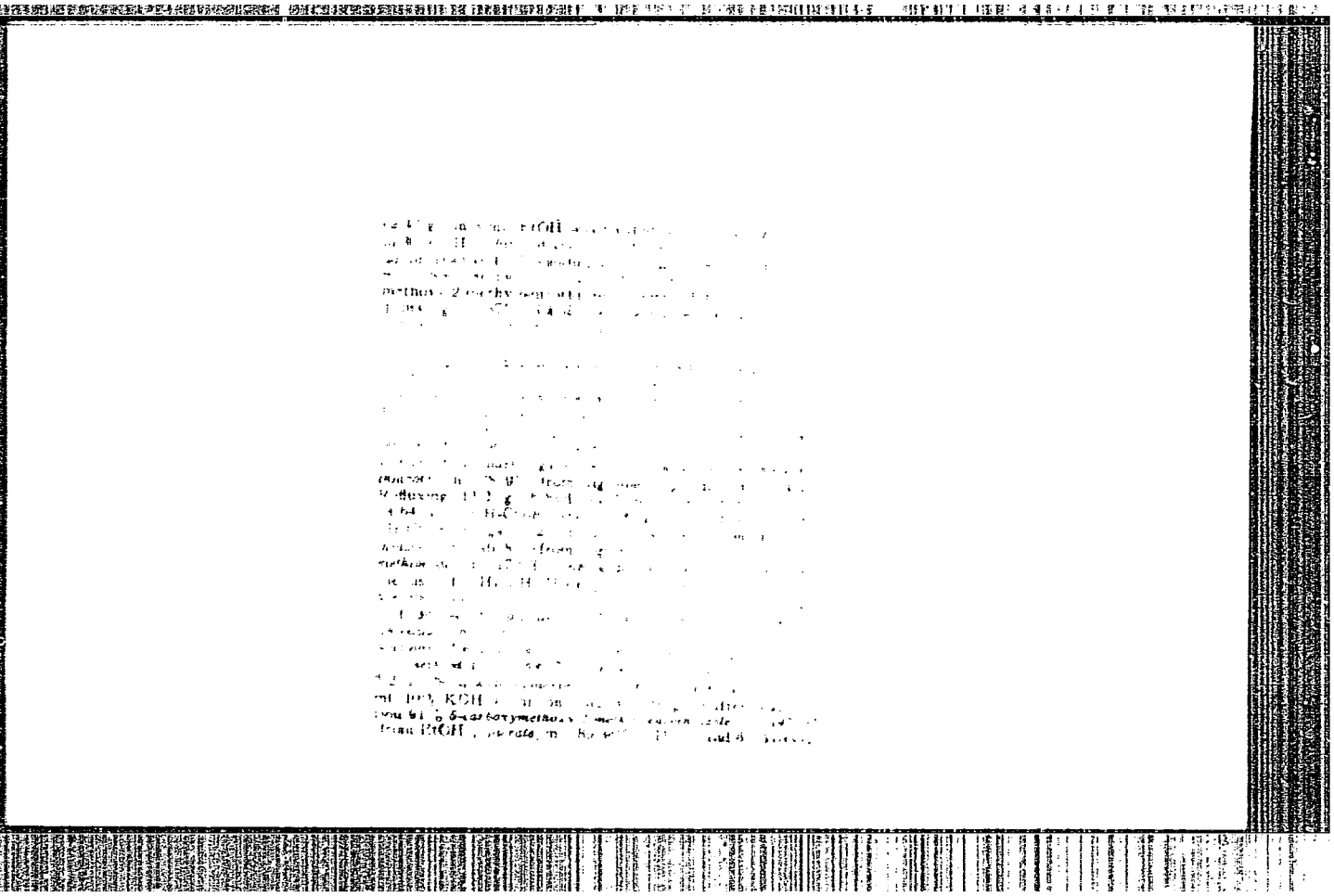
ZHIRYAKOV, V.G.; LEVKOYEV, I.I.

Synthesis of 2-methyl-4, 5-thiopheno-(2,3)'thiazole. Dokl. AN SSSR 120 no. 5:1035-1037 Je '58. (MIRA 11:8)

1. Vsesoyuznyy nauchno-issledovatel'skiy kino-foto institut. Predstavleno akademikom I.L.Kununyantsem.
(Thiazole)

USSR.

Cyanine dyes VIII. Some 5,5' an[illegible] disubstituted thiacarbocyanines. I. Levkoev, [illegible] Sveshnikov, and N. S. Barvyn (M. V. Lomonosov Inst. Fine Chem. Technol., Moscow). [illegible] Khim. 2, 1203-72 (1953) [illegible] C.A. 41 [illegible] 48, 2499a.—Heating 53 [illegible] HNO$_3$ (d. 1.1 [illegible]) 5 hr. to 40° followed [illegible] at 40°, diln. with [illegible] heating slowly [illegible] after cooling [illegible] hydrolysis of the [illegible] HCl [illegible] 6-Bromophenetole [illegible] [illegible] analog [illegible] C$_6$H [illegible] ext. after acidification with AcOH [illegible] and diphenyl ether [illegible] EtOH [illegible]



[illegible] quaternary salts, which were [illegible] desired orthoacetanilyls, solid ester and [illegible] 5°, the product taken up in EtOH and treated with KI soln. to yield the following thiacarbocyanine iodides (substituents given): *3,3'-diethyl-5,5'-diethoxy*, green, decomp 290°; *3,3'-diethyl-9-methyl-5,5'-diethoxy* green, decomp 234°; *3,3'-diethyl-5,5'-diethoxy* [illegible] *3,3'-dimethyl-9-ethyl-5,5'-diethoxy*, red, decomp [illegible] *diethyl-6,6'-dethoxy*, green, decomp. 250°, *3,3'-diethyl-9-methyl-6,6'-dethoxy*, red-violet, decomp 296.5° *3,3'-triethyl-6,6'-diethoxy*, green, decomp 240°, *3,3'-trimethyl-9-ethyl-6,6'-diethoxy*, red, decomp 259°, *3,3'-diethyl-5,5'-dibenzyloxy*, violet-brown, decomp 221° *3,3'-diethyl-9-methyl-5,5'-dibenzyloxy* red-brown, decomp 222° *3,3'-triethyl-5,5'-dibenzyloxy*, blue-violet decomp [illegible] *diethyl-6,6'-dibenzyloxy*, green, decomp 217° *3,3'-diethyl-9-methyl-6,6'-dibenzyloxy*, red-brown decomp [illegible] *3,3'-triethyl-6,6'-dibenzyloxy*, blue, decomp 211° *3,3'-dimethyl-9-ethyl-6,6'-dibenzyloxy*, red-brown, decomp 224° *3,3'-diethyl-5,5'-dicarbethoxymethoxy*, violet, decomp 201° *3,3'-diethyl-9-methyl-5,5'-dicarbethoxymethoxy*, red-brown, decomp. 223°; *3,3',9-triethyl-5,5'-dicarbethoxymethoxy*, blue decomp 195°, *3,3'-diethyl-4,6'-dicarbethoxymethoxy* green.

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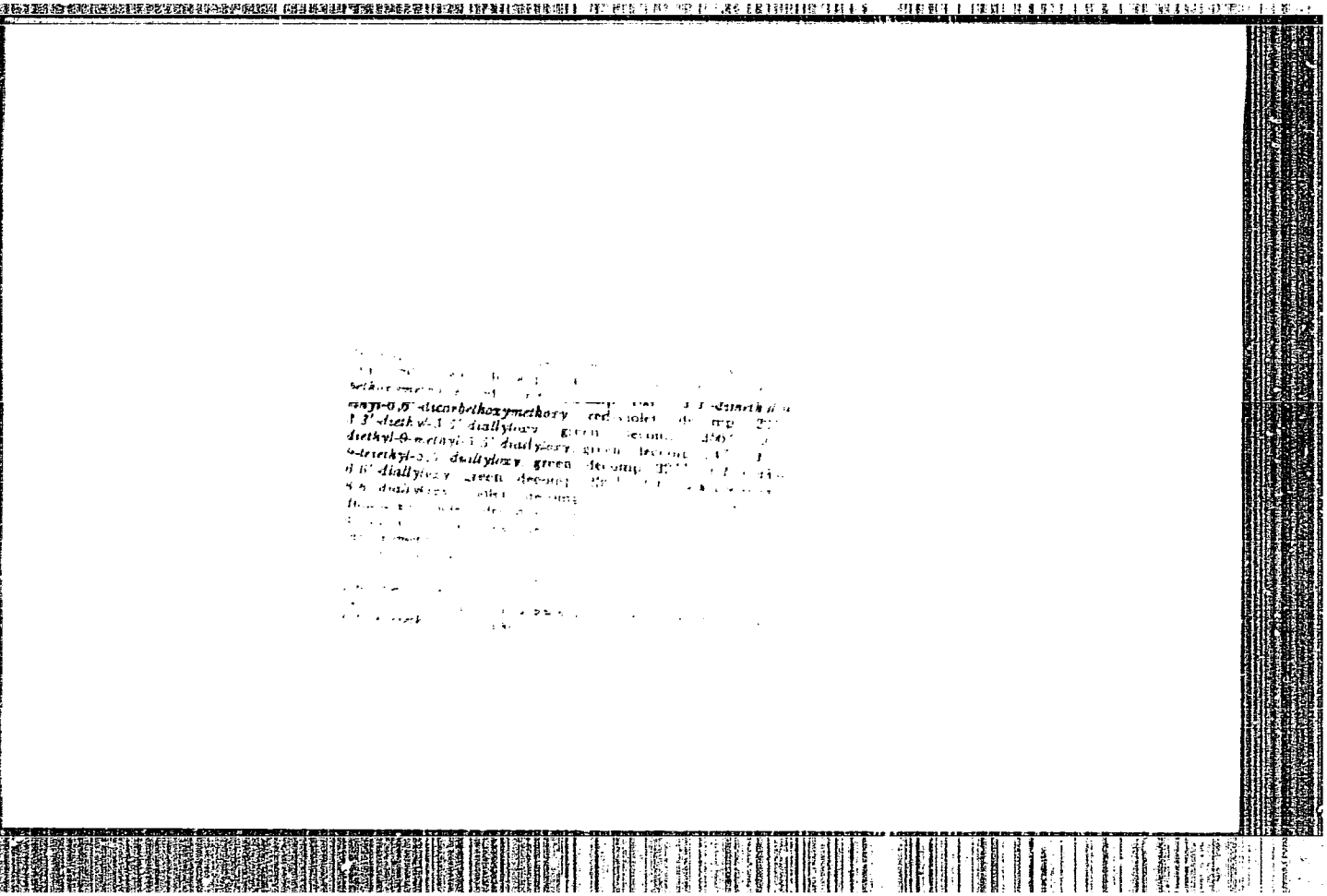

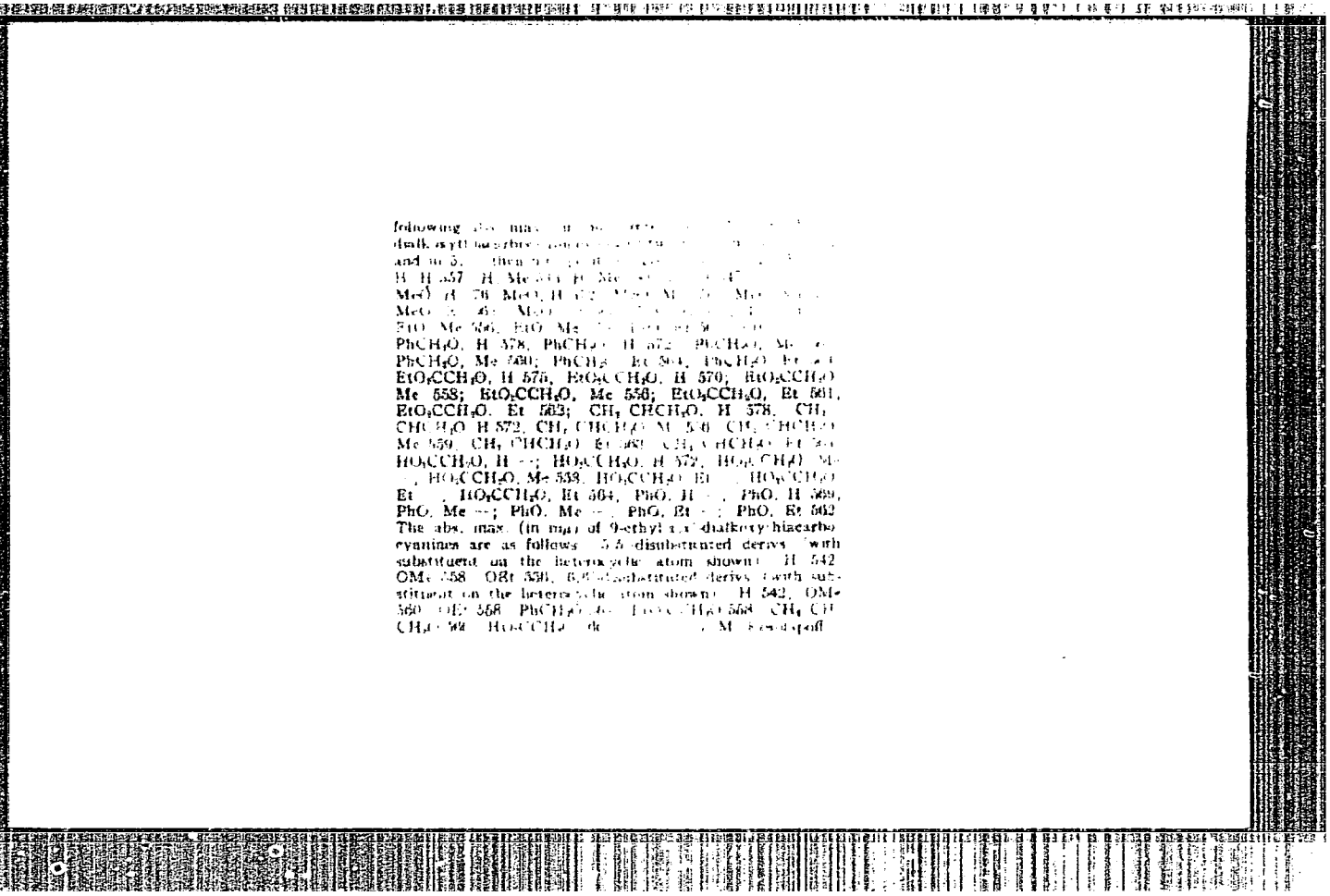

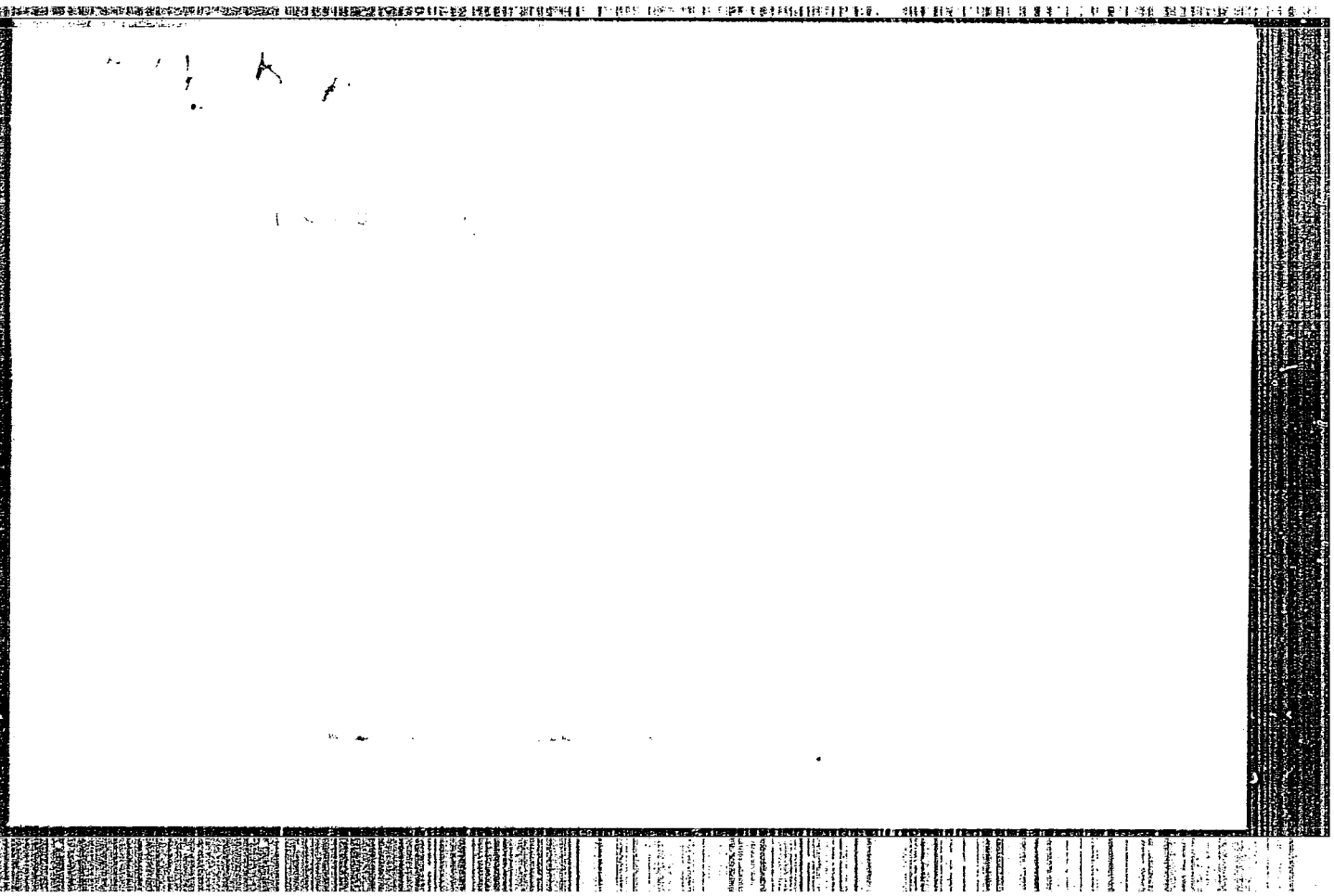

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ZHIRYAKOV, V.G.

Defense of dissertations at the All-Union Research Institute of Cinematography in 1955. Zhur. nauch. i prikl. fot. i kin. 1 no. 4:313-314 Jl-Ag '56. (MLRA 9:10)

(Cinematography)

ZHIRYAKOV, V.G.; ABRAMENKO, P.I.

Synthesis of 4-methyl-5,6-thiophenopyridines. Zhur. VKHO 5 no.6:707-708 '60. (MIRA 13:12)

1. Vsesoyuznyy nauchno-issledovatel'skiy kino-fotoinstitut.
(Pyridine)

ZHIRYAKOV, V. G.

Polymethine dyes, derivatives of heterocyclic bases containing condensed thiophene rings. Part 1: Derivatives of thienothiazoles. Zhur.ob.Khim. 34 no.6:2034-2039 Je '64. (MIRA 17:7)

1. Vsesoyuznyy nauchno-issledovatel'skiy kino-fotoinstitut.

AERAMENKO, P.I.; ZHIRYAKOV, V.G.

Polymethine dyes, derivatives of heterocyclic bases containing condensed thiophene rings. Part 3: Polymethine dyes, derivatives of thionaphthene-4-pyridines. Zhur. org. khim. 1 no.6:1132-1137 Je '65. (MIRA 18:7)

1. Vsesoyuznyy nauchno-issledovatel'skiy kinofotoinstitut (NIKFI).

ZHIRYAKOV, V.G.; ABRAMENKO, P.I.

Polymethine dyes, derivatives of heterocyclic bases containing condensed thiophene rings. Part 2: Polymethine dyes, derivatives of thienopyridines. Zhur. ob. khim. 35 no.1:150-153 Ja '65. (MIRA 18:2)

1. Vsesoyuznyy nauchno-issledovatel'skiy kinofotoinstitut.

SOSNIN, A.G., kand.tekhn.nauk; ZHIRYAKOV, V.N., gornyy inzh.; DANILOV, N.A., gornyy tekhnik

Operation of the the KLTs-1 belt-and-chain conveyer. Ugol' Ukr. 5 no.1:40-41 Ja '61. (MIRA 14:1)
(Conveying machinery)

SUKHOV, G.M.; ZHIRYAKOV, V.N.; DANILOV, N.A.; DURAKOV, V.M.

Operations of Mine No.54. Ugol' Ukr. 4 no.9:29-30 S '60.
(MIRA 13:10)

1. Glavnyy inzhener shakhty No.54 tresta Bokovoantratsit (for Sukhov). 2. Pomoshchnik glavnogo inzhenera shakhty No.54 tresta Bokovoantratsi (for Zhuryakov). 3. Pomoshchnik glavnogo mekhanika shakhty No.54 tresta Bokovoantratsit (for Danilov).
(Donets Basin--Coal mines and mining)

ZHIRYAKOV, Yu.A.

Improving and reducing the cost of water meters. Vod.i san. tekh. no.9:11-14 D '55. (MLRA 9:3)
(Water meters)

RUDANOVSKIY, A.A., starshiy nauchnyy sotrudnik; ZHIRYAKOV, V.N.

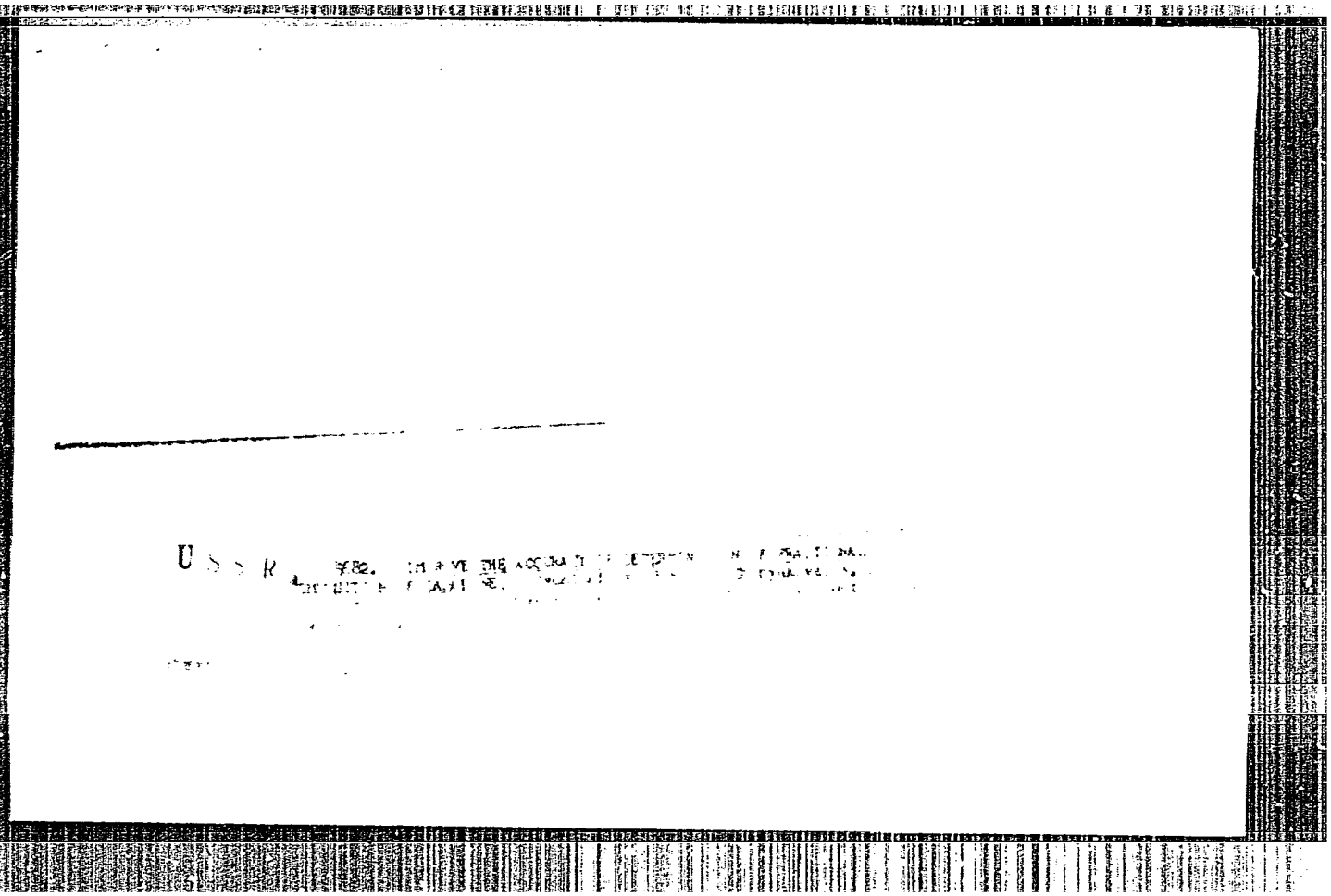
Automatic driving of the cutter-loader along the coal-rock contact.
Ugol' Ukr. 5 no.4:34-35 Ap '61. (MIRA 14:4)

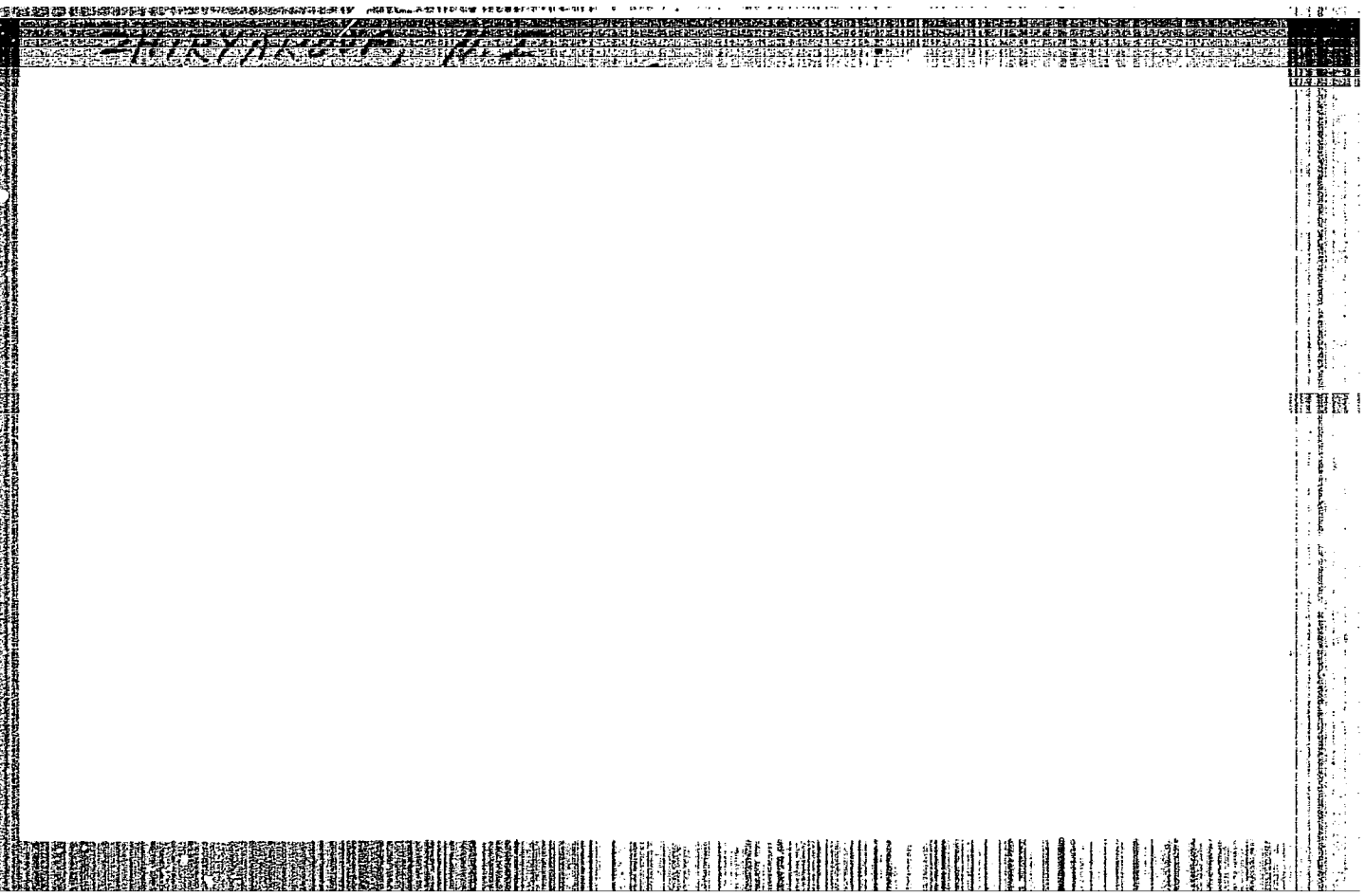
1. Institut gornogo dela AN SSSR (for Rudanovskiy). 2. Glavnyy inzh.shakhty No.54 tresta Bokovoantratsit (for Zhiryakov).
(Coal mining machinery) (Automatic control)

ZHIRYAKOVA, I. S.

Bibliography of the published works of Academician I. V. Kurchatov. Atom energ. 14 no.1:128-131 Ja '63.
(MIRA 16:1)

(Bibliography--Physics)





APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R002064820010-8"

ZHIRYAKOVA, N.I.

AID P - 1352

Subject : USSR/Chemistry

Card 1/1 Pub. 78 - 15/30

Authors : Ovchinnikov, B. N. and Zhiryakova, N. I.

Title : Increased accuracy of analysis of fractional composition of gasoline.

Periodical : Neft. khoz., v.32, #12, 51-53, D 1954

Abstract : The accuracy of the analysis of the fractional composition of gasolines as determined in accordance with the standard (GOST 2177-48) is discussed. Experimental parallel analyses in two apparatuses indicate that the standard tests can produce more accurate results if the limits of fractionation temperature are reduced from 4°C to 2°C and 2° to 1°C for the end temperatures. Three tables.

Institution: None

Submitted : No date

OVCHINNIKOV, B.N.; ZHIRYAKOVA, N.I.

Increase the accuracy of analyses in determining the fractional composition of gasoline. Neft.khoz. 32 no.12:51-53 D '54.
(Gasoline) (MLRA 8:2)

ZHIRYAKOVA, M.P.

Work experience of an interdistrict control worker. Vest. sviazi 16 no.9:21 S '56. (MLRA 9:11)

1. Mezhrayonnyy kontroler Dmitrovskogo i Trosnyanskogo rayonov Orlovskoy oblasti.
(Orlov Province--Telecommunication)

GLEYM, V.G.; ZHISHCHENKO, V.I.; LAVROVA, E.M.; TERESHCHENKO, S.G.

Electrochemical cleaning of petroleum products from the surface of metal. Izv. vys. ucheb. zav.; neft' i gaz 5 no.1:87-91 '62. (MIRA 16:11)

1. Rostovskiy-na-Donu institut inzhenerov zheleznodorozhnogo transporta.

ZHISHCHENKO, V.I., kand. khim. nauk

Corrosion of bronze in boiler media with increased multiple factor of concentration. Trudy RIIZHT no.28:139-147 '59.
(MIRA 16:7)

(Bronze--Corrosion) (Volovik, M.A.)

Zhishchenko, V. I. --Effect of Catalysts on Electro-oxidation and Electroreduction of Organic Compounds." Cand Chem Sci, Rostov State U, Rostov-on-Don 1953. (Referativnyy Zhurnal--Khimiya, No 1. Jan 54)

Source: SUM 168, 22 July 1954

KHURGIN, M.E.; ZHISLIN, F.A.

Ultrasonic testing of rods. Zav.lab. no.4:458 '60.
(MIRA 13:6)

(Elastic roads and wires)
(Ultrasonic testing)

S/032/60/026/04/17/046
B010/B006

AUTHORS: Khurgin, M.E., Zhislin, F.A.

TITLE: Ultrasonic Control of Rods

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 4, p. 458

TEXT: To detect defects in round rods, the ultrasonic contact-echo method was applied. A device of the type UZ-7I and a sound pickup with a beryllium header were used. In sounding, not only the period from the fading out of the initial pulse to the occurrence of the first echo from the defect are observed on the screen, but also the subsequent echoes. The pulse height of the second and third echoes was found to be larger than that of the first. This is ascribed to a better focusing of sound waves after the first echo, and to a slighter dependence of echo pulse heights following the first echo on the angle of incidence of the sound ray. Since additional echoes occur after the third echo, only the period preceding the third echo was investigated for production tests.

Card 1/1

AUTHOR: ZHISLIN, G.M.

TITLE: On the Existence of the Eigenfunctions for the Schrödinger Equation (O sushchestvovanii sobstvennykh funktsiy dlya uravneniya Shredingera)

PERIODICAL: Doklady Akademii Nauk SSSR, 1957, Vol. 117, Nr 6, pp 931-934 (USSR)

ABSTRACT: Given the Schrödinger equation

$$(1)\quad H\psi = E\psi,\quad H\psi = -\sum_{i=1}^{n} a_i \Delta_i \psi - \sum_{i=1}^{n} b_i \frac{\psi}{r_i} + \sum_{i<j}^{1,n} c_{ij} \frac{\psi}{r_{ij}},$$

where $\psi = \psi(P)$ is the wave function of the system defined in the whole Euclidean R_{3n}, $P = P(x_1,\ldots,x_n,y_1,\ldots,y_n,z_1,\ldots,z_n)$ is a point of the R_{3n}, $\Delta_i = \frac{\partial^2}{\partial x_i^2} + \frac{\partial^2}{\partial y_i^2} + \frac{\partial^2}{\partial z_i^2}$, $r_i = \sqrt{x_i^2+y_i^2+z_i^2}$, $r_{ij} = \sqrt{(x_i-x_j)^2+(y_i-y_j)^2+(z_i-z_j)^2}$ and a_i, b_i, c_i are positive numbers.

Theorem: Let the coefficients of (1) satisfy the inequations

On the Existence of the Eigenfunctions for the Schrödinger Equation 20-6-2/47

$$b_i > \sum_{j \neq i}^{1,n} c_{ij} \qquad i=1,2,\ldots,n.$$

Then there exists an infinite sequence of eigenvalues of (1); the multiplicity of every eigenvalue is finite; the eigenfunctions are differentiable arbitrarily often and they satisfy (1) in every point lying on none of the manifolds $r_i = 0$, $r_{ij} = 0$ $(i=1,2,\ldots,n;\ 1 \leqslant i < j \leqslant n)$.

The theorem results as a conclusion of several lemmas and the results due to Friedrichs [Ref.7].

4 Soviet and 3 foreign references are quoted.

ASSOCIATION: Gor'kiy State University im.N.I.Lobachevskiy (Gor'kovskiy gosudarstvennyy universitet im.N.I.Lobachevskogo)

PRESENTED: By V.I.Smirnov, Academician, 21 June 1957
SUBMITTED: 20 June 1957
AVAILABLE: Library of Congress
Card 2/2

SOV/20-122-3-2/57

AUTHOR: Zhislin, G.M.

TITLE: On the Spectrum of the Schrödinger Operator (O spektre operatora Shredingera)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 122, Nr 3, pp 331-334 (USSR)

ABSTRACT: The article could not be abstracted because the initial equation in the original text was distorted. Professor A.G. Sigalov was mentioned as the person in charge of the study. There are 5 Soviet references.

ASSOCIATION: Gor'kovskiy gosudarstvennyy universitet imeni N.I. Lobachevskogo (Gor'kiy State University imeni N.I. Lobachevskiy)

PRESENTED: May 19, 1958, by V.I. Smirnov, Academician

Card 1/1

16(1)

AUTHOR: Zhislin, G.M. SOV/20-128-2-3/59

TITLE: A Characteristic of the Spectrum of the Schrödinger Operator for Molecular Type Systems

PERIODICAL: Doklady Akademii nauk SSSR, 1959,Vol 128,Nr 2,pp 231-234 (USSR)

ABSTRACT: The author considers the nonrelativistic Schrödinger operator for a system of n particles:

$$(1)\quad H = -\sum_{i,j=1}^{n}\sum_{\gamma=0}^{2} a_{ij}\frac{\partial^2}{\partial x_{3i-\gamma}\partial x_{3j-\gamma}} + \sum_{i,j=0,i<j}^{n} V_{ij}(\varkappa_{ij}),$$

where $a_{ij} = a_0$ for $i \neq j$; $a_{ii} = a_i + a_0$; $a_i > 0$ arbitrary numbers, $x_{3i-\gamma}$, $\gamma = 0,1,2$; $i = 1,\ldots,n$ - variables of the 3n-dimensional Euclidean space R_n; $\varkappa_{0j} = \varkappa_j = \{x_{3j-2}, x_{3j-1}, x_{3j}\}$, $j \geq 1$; $\varkappa_{ij} = \varkappa_i - \varkappa_j$, $i,j \geq 1$; $V_{ij}(\varkappa_{ij}) = V_{ji}(\varkappa_{ji})$ real functions measurable in R_n.

Let $\widetilde{H}$ be a selfadjoint extension of H as in [Ref 1,2]. The author uses partially results of [Ref 1,2]. Let

$$(2)\quad \lim_{r_{ij}\to\infty} V_{ij}(\varkappa_{ij}) = 0;$$

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(3) $V_{ij} \leq 0, \quad i \in S, \quad j \in T$

and $V_{ij} \geq 0$, $i,j \in S$, $i,j \in T$ everywhere in R_n, where $S=\{0,1,\ldots,p\}$, $T = \{p+1,\ldots,n\}$, $0 \leq p \leq n$; for every $\psi \in W_2^1$ and $E \subseteq R_n$ let

(4) $$\sum_{i<j}^{0,n} \int_E |V_{ij}(x_{ij})|\psi|^2 d\Omega \leq M_0 \left(\sum_{l=1}^{t} \|\operatorname{grad}\psi\|^{2c_l} \|\psi\|_E^{2d_l} + \|\psi\|_E^2 \right),$$

where t, $M_0 > 0$, $c_l \geq 0$, $d_l > 0$, $c_l + d_l = 1$ are constants not depending on ψ and E.

Principal theorem: Let the V_{ij} in (1) satisfy the conditions (2)-(4). Then there exists a μ, $\mu \leq 0$, so that the limit spectrum of $\hat{H}$ is identical with all points of the ray $[\mu, +\infty)$. For the existence of a discrete spectrum of $\hat{H}$ it is necessary and sufficient that

$$\inf_{\psi \in Q_0} L[\psi] < \mu,$$

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A Characteristic of the Spectrum of the Schrödinger Operator for Molecular Type Systems

SOV/20-128-2-3/59

where $Q_0 = \{\psi, \psi \in W_2^1, \|\psi\| = 1\}$.

$$L[\psi] = (\tilde{H}\psi, \psi) = \sum_{i,j=1}^{n} \sum_{\gamma=0}^{2} a_{ij} \int \frac{\partial \psi}{x_{3i-\gamma}} \frac{\partial \bar{\psi}}{x_{3j-\gamma}} d\Omega + \sum_{i,j=0, i<j}^{n} \int V_{ij}(r_{ij}) |\psi|^2 d\Omega.$$

The author thanks A.G.Sigalov for giving the problem and M.S. Birman for advice .

There are 2 Soviet references.

ASSOCIATION: Nauchno-issledovatel'skiy radiofizicheskiy institut pri Gor'kovskom gosudarstvennom universitete imeni N.I.Lobachevskogo (Scientific Radio Physical Research Institute at the Gor'kiy State University imeni N.I.Lobachesvkiy)

PRESENTED: May 7, 1959, by V.I.Smirnov, Academician

SUBMITTED: May 7, 1959

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ZHISLIN, G. M. Cand Phys-Math Sci -- " Study of the spectrum of the Schroedinger operator." Mos, 1960. (Min of Higher and Specialized Secondary Education RSFSR. Mos State Univ im M. V. Lomonosov). (KL, 1-61, 179)

30002

S/550/60/009/000/001/008
D218/D305

24.4400

AUTHOR: Zhislin, G.M. (Gor'kiy)

TITLE: A study of the spectrum of the Schrödinger operator for a many-particle system

SOURCE: Moskovskoye matematicheskoye obshchestvo. Trudy, v. 9, 1960, 81 - 120

TEXT: The results reported in the present paper were first communicated to the Moscow Mathematical Society on April 15, 1958. The author investigates the spectrum of the following operator for a system of n particles:

$$H = -\sum_{i,j=1}^{n}\sum_{\gamma=0}^{2} a_{ij}\frac{\partial^2}{\partial x_{3i-\gamma}\partial x_{3j-\gamma}} + \sum_{\substack{i,j=0\\ i<j}}^{n} V_{ij}(r_{ij}), \qquad (0.1)$$

where $x_{3i} - \gamma$ ($\gamma = 0, 1, 2$; $i = 1, 2, \ldots, n$) are the coordinates of a $3n$ - dimensional Euclidian space R_n, $\underline{r}_{ij} = \underline{r}_i - \underline{r}_j$, $\underline{r}_j =$

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$\{x_{3j-2}, x_{3j-1}, x_{3j}\}$ $(i, j \geqslant 1)$, $r_{oj} = r_j$ $(j = 1, 2, \ldots, n)$, $a_{ij} = a_{ji}$ are the coefficients of the positive-definite expression,

$$c_0 = \inf \sum_{\sum_{i=1}^{n} \gamma_i^2 = 1}^{n} a_{ij}\gamma_i\gamma_j > 0; \qquad (0.2)$$

and $V_{ij}(r_{ij})$ are functions defined in R_n. In general these functions have no lower bounds and may possess properties which are not necessarily localized in R_n. It is stated that although the above Schrödinger operator is widely used in quantum mechanics, its spectrum for $n \geqslant 2$ has not been studied to any great extent. In the present paper, the author establishes the necessary and sufficient condition for the existence of the discrete spectrum and derives the continuous spectrum of the operator H for a system consisting of an arbitrary number of equally charged particles, located in the field of a number of fixed particles of a different sign. The existence of the continuous and discrete spectra is established for a less general class of systems and it is shown that

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if the system under consideration takes the form of an atom, a positive ion or a molecule, then the discrete spectrum of H consists of an enumeratable sequence of points. The existence of eigenvalue which lie on the continuous spectrum of H is said to remain uninvestigated. The results now reported were originally published by the author in (Ref. 4: DAN, v. 117, no. 6, 931-934, 1957) and (Ref. 5: DAN, v. 122, no. 3, 1958, 331-334). The present report gives a more detailed account of these results and generalizes them to a larger class of systems. The three theorems which are proved read as follows: Theorem I: Let the function $V_{ij}(\underline{r}_{ij})$ satisfy the conditions

1) $$\lim_{r_{ij} \to \infty} V_{ij}(\underline{r}_{ij}) = 0 \qquad (1.1)$$

2) a. $V_{oi}(\underline{r}_{oi}) \leqslant 0$, b. $V_{ij}(\underline{r}_{ij}) \geqslant 0$ $(i < j;\ i, j = 1, 2, .., n)$ (1.2)

3) $$\int_{|x_1|+|x_2|+|x_3|<N} |V_{ij}(x_1, x_2, x_3)|^2 dx_1 dx_2 dx_3 < +\infty \quad (i<j;\ i, j = 0, 1, \ldots, n), \qquad (1.3)$$

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4) for any function from W_2^1 and any region $E \subseteq R_n$

$$\sum_{i,j=0,\ i<j}^{n} \int_E |V_{ij}(r_{ij})|\,|\psi|^2\,d\Omega < M_0\left(\sum_{l=1}^{t_0} \|\,|\mathrm{grad}\,\psi|\,\|^{2c_l} \|\psi\|_E^{2d_l} + \|\psi\|_E^2\right), \qquad (1.4)$$

where $M_0 > 0$, $c_l \geqslant 0$, $d_l > 0$, $c_l + d = 1$, t_0 are constants which are independent of the choice ψ and E, and $l = 1, 2, \ldots, t_0$. Then, there exists a number $\mu \leqslant 0$ which is such that the entire continuous spectrum of the operator H consists of all $\lambda \geqslant u$. The necessary and sufficient condition that the discrete spectrum of H should exist is

$$\inf_{\psi \in Q_0} L[\psi] < \mu \qquad (1.5)$$

where $L[\psi] = (H\psi, \psi)$, $Q_0 \equiv \{\psi,\ \psi \in W_2^1,\ //\psi// = 1\}$. Theorem II: Let the function $V_{ij}(\underline{r}_{ij})$ satisfy the conditions given by (1.1) - (1.4) and suppose further that for any function $\varphi(\underline{r}_1, \ldots, \underline{r}_{i_0-1}, \underline{r}_{i_0+1},$

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..., $\underline{r}_n$) from $W_2^1(R^{(i_0)})$ there exists a real function $g_1(\underline{r}_{i_0})$ from $C_2^f(R^{i_0})$ and numbers $\{k_m\}$, $k_m > 0$ ($m = 1, 2, \ldots$), $k_m \to 0$ when $m \to \infty$; α, $0 \leq \alpha < 2$, $\omega_0 > 0$ and $N > 0$, which are such that for $m > N$,

$$\left.\begin{aligned} &\text{a)}\ \int V_{01}(r_1)|g_{k_m}|^2\,d\Omega < -\omega_0 k_m^\alpha \quad (n=1),\\ &\text{b)}\ \sum_{\substack{j=0\\ j\neq i_0}}^{n} \int V_{i_0 j}(r_{i_0 j})|\varphi g_{k_m}|^2\,d\Omega < -\omega_0 k_m^\alpha \quad (i_0 = 1, 2, \ldots, n;\ n>2), \end{aligned}\right\} \qquad (1.6)$$

where $g_{k_m} = k_m^{3/2} g_1(k_m \underline{r}_{i_0})$ u $V_{i_0 j}(\underline{r}_{i_0 j}) = V_{j i_0}(\underline{r}_{j i_0})$ when $j < i_0$. Then, the lower boundary of the spectrum of H is a point belonging to the discrete spectrum, and the number u defined by Theorem I is negative for $n \geq 2$. Theorem III: Suppose that in the expression for H

$$V_{ij}(\underline{r}_{ij}) = c_{ij} \frac{1}{r_{ij}} \quad (i, j = 1, 2, \ldots, n;\ i < j), \qquad (1.7)$$

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$$V_{0i}(r_{0i}) = -\sum_{l=1}^{n_0} b_{il}\frac{1}{r_{\alpha_l i}} \quad (i = 1, 2, \ldots, n), \tag{1.7}$$

where $r_{\alpha_l i} = \sqrt{\sum_{\gamma=0}^{2}(x_{3i-\gamma} - \alpha_{3l-\gamma})^2}$; $c_{ij} = c_{ji}$, $b_{li} = b_{il}$, are any non-negative numbers. Then, there exists a number $\mu \leqslant 0$ which is such that the entire continuous spectrum of the operator H consists of all numbers $\lambda \geqslant \mu$. Moreover, if

$$\sum_{l=1}^{n_0} b_{il} > 0 \quad \text{при } n = 1, \quad \text{или} \quad \sum_{l=1}^{n_0} b_{il} > \sum_{\substack{j=1 \\ j\neq i}}^{n} c_{ij} \quad (i = 1, 2, \ldots, n;\ n > 2), \tag{1.8}$$

then the discrete spectrum of H consists of an infinite and increasing sequence of eigenvalues λ_p ($p = 1, 2, \ldots$), and $\lim_{p\to\infty} \lambda_p = \mu$, where $\mu = 0$ when $n = 1$, and $\mu < 0$ when $n \geqslant 2$. It is stated that the notation employed is defined in detail by Ye.F. Zhizhenkova

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and the author (Ref. 6: Trudy Mosk. matem. O-va, v. 9, 121-128, 1960). Acknowledgements are expressed to Professor Sigalov who directed this work. There are 16 references: 12 Soviet-bloc and 4 non-Soviet-bloc. The references to the English-language publications read as follows: T. Kato, Trans. Amer. Math. Soc. 70, 2, 1951, 212; C.R. Putnam, Quart. Appl. Math. 14, 1, 1956, 101; T. Kato, Comm. pure and appl. math. 10, 2, 1957, 151; T. Kato, Trans. Amer. Math. Soc. 70, 2, 1951, 196;

SUBMITTED: March 7, 1959

Card 7/7

ZHIZHENKOVA, Ye.F.; ZHISLIN, G.M. (Gor'kiy)

Existence of a minimum for some quadratic fuctionals in an unlimited region. Trudy Mosk.mat.Ob-va 9:121-128 '60.
(MIRA 13:9)

(Functional analysis)

86860

S/141/60/003/005/015/026
E192/E382

6.9000

AUTHOR: Zhislin, G.M.

TITLE: The Problem of Evaluation of the Product of the Signal Duration and Its Spectrum Width

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1960, Vol. 3, No. 5, pp. 860 - 865

TEXT: F is assumed to be the ensemble of all the real functions f(t) for which:

$$\int_{-\infty}^{+\infty} t^2 f^2(t)dt < +\infty, \quad \int_{-\infty}^{+\infty} f^2(t)dt = 1 \quad .$$

If $f \in F$,

$$A(u) = \frac{1}{\pi}\int_{-\infty}^{+\infty} f(t)\cos(ut)dt, \quad B(u) = \frac{1}{\pi}\int_{-\infty}^{+\infty} f(t)\sin(ut)dt \qquad (1).$$

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The Problem of Evaluation of the Product of the Signal Duration and Its Spectrum Width

Then, on the basis of the Fourier-Plancherelle theorem:

$$f(t) = \int_0^{\infty} \left[A(u)\cos(ut) + B(u)\sin(ut)\right] du \qquad (2) .$$

L.I. Mandel'shtam set the problem of evaluating the highest μ for which:

$$K = \int_{-\infty}^{+\infty} (t - t_o)^2 f^2(t)dt \int_0^{\infty} (u - u_o)^2 \left[A^2(u) + B^2(u)\right] du \geq \mu$$

for all t_o, u_o and $f \in F$. This problem is of interest

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in radiophysics and it was solved by A.G. Mayer (Ref. 2) under the assumptions that the function $f_o(t)$ and the number u_o existed. In the following an attempt is made to demonstrate the validity of this assumption. First, it is assumed that $t_o = 0$ and it is shown that the problem consists of determining the existence of a vector q_o which realises the minimum of the function:

$$K[q] = \pi \int_0^\infty \left[A'^2(u) + B'^2(u) \right] du \int_0^\infty (u - v)^2 \left[A^2(u) + B^2(u) \right] du$$

which belongs to class Q. In this equation v is an arbitrary real number. It is shown that μ can be expressed by:

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$$\mu = \lim_{m \to \infty} K[g_m] \geq K[g_o] \qquad (13)$$

from which it follows that $K[g_o] = \mu$.

There are 7 references: 5 Soviet and 2 English.

ASSOCIATION: Nauchno-issledovatel'skiy radiofizicheskiy institut pri Gor'kovskom universitete (Scientific Research Radiophysics Institute of Gor'kiy University)

SUBMITTED: June 7, 1960

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S/044/62/000/009/021/069
A060/A000

AUTHOR: Zhislin, G.M.

TITLE: Investigation of the spectrum of the Schroedinger operator

PERIODICAL: Referativnyy zhurnal, Matematika, no. 9, 1962, 53, abstract 9B253 (In collection "Funktsional'n. analiz i yego primeneniye", Baku, AN AzerbSSR, 1961, 65 - 69)

TEXT: The Schroedinger operator is considered for a system of "n" particles

$$H = -\sum_{i,j}^{1,n} \sum_{\gamma}^{0,2} a_{ij}^{0} \frac{\partial^2}{\partial x_{3i-\gamma} \partial x_{3j-\gamma}} + \sum_{i<j}^{0,n} V_{ij}(r_{ij}), \qquad (1)$$

where $a_{ii}^{0} = a_1 + a_0$, $a_{ij}^{0} = a_0$ for $i \neq j$, $a_1 > 0$, $a_0 \geq 0$ are arbitrary constants, $V_{ij}(r_{ij})$ are functions measurable in R_n. The operator H is taken over the set G_H of all finite functions twice continuously differentiable in R_H. Let

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$\widetilde{H}$ be a self-adjoint continuation in the sense of Friedrichs of the operator H from G_H. Let the functions V_{ij} be such that

$$\lim_{r_{ij} \to \infty} V_{ij}(r_{ij}) = 0, \quad 1 \leq j, \; i, \; j = 1, \ldots, n ; \tag{2}$$

for any bounded region Ω of R_n $\int_{\Omega} |V_{ij}(r_{ij})|^2 \, d\Omega < +\infty$; (3)

for any function Ψ from $W_2^{(1)}$ and any region $E \subset R_n$

$$\sum_{i<j}^{0,n} \int |V_{ij}(r_{ij})| \cdot |\Psi|^2 \, d\Omega \leq$$

$$\leq M_0 \left(\sum_{k}^{1,t} \| \operatorname{grad} \Psi \|_{E}^{2c_k} \| \Psi \|_{E}^{2d_k} + \| \Psi \|_{E}^{r} \right) , \tag{4}$$

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where $M_0 > 0$, $C_k \geq 0$, $d_k > 0$, $C_k + d_k = 1$, t is a constant independent of the choice of Ψ and E. Then the following theorems hold: Theorem 1. Let the functions $V_{ij}(r_{ij})$, $i < j$, $i, j = 0, 1, \ldots, n$, satisfy the conditions (2) - (4). Then there exists a number μ, $\mu \leq 0$, such that the complete limiting spectrum of the operator $\widetilde{H}$ consists of all the numbers $\lambda \geq \mu$. For a discrete spectrum of $\widetilde{H}$ to exist, it is necessary and sufficient that $\inf L[\Psi] < \mu$, where $Q_0 = \{\Psi, \Psi \in W_2^{(1)}, \|\Psi\| = 1\}$, $\Psi \in Q_0$

$$L[\Psi] = (\widetilde{H}\Psi, \Psi) = \sum_{i,j}^{1,n} \sum_{\gamma}^{0,2} a_{ij}^{0} \int_{R_n} \frac{\partial \Psi}{\partial x_{3-\gamma}} \frac{\partial \Psi}{\partial x_{31-\gamma}} d\Omega + \int_{R_n} \sum_{i<j}^{0,n} V_{ij}(r_{ij}) |\Psi|^2 d\Omega,$$

Theorem 2. $V_{ij}(r_{ij}) = \frac{c_{ij}}{r_{ij}}$, $i, j = 1, \ldots, n$; $i < j$,

$$V_{0j}(r_{0j}) = \sum_{k}^{1,n_0} b_{\xi_k j} \frac{1}{r_{\xi_k j}}, \quad j = 1, \ldots, n, \quad \text{where}$$

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$$r_{\xi_k j} = \sqrt{\sum_{\gamma}^{0,n} (x_{3j-\gamma} - \xi_{3k-\gamma})^2}, \quad c_{ij} = c_{ji}, \quad b_{\xi_k, j} \quad —$$

are arbitrary non-negative numbers. Then there exists a number $\mu \leqslant 0$ such that the complete limiting spectrum of the operator $\widetilde{H}$ consists of all the numbers λ, $\lambda \geq \mu$. The proofs are not given.

[Abstracter's note: Complete translation]

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22409
S/042/61/016/001/003/007
C 111/ C 333

16.3500

AUTHOR: Zhislin, G. M.

TITLE: On the nodes of the eigenfunctions of the Schrödinger operator

PERIODICAL: Uspekhi matematicheskikh nauk, v. 16, no. 1, 1961, 149-152

TEXT: Let the Schrödinger equation

$$H\psi = \sum_{\gamma=0}^{2} \sum_{i,j=1}^{n} a_{ij} \frac{\partial^2 \psi}{\partial x_{3i-\gamma} \partial x_{3j-\gamma}} + v\psi = \lambda\psi \qquad (1)$$

be given, where $x_{3i-\gamma}$ ($\gamma = 0,1,2$; $i=1,\ldots,n$) are coordinates of the 3n-dimensional Euclidean R_n, a_{ij} -- coefficients of a positive definite, quadratic form:

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$$V = V_1 = -\sum_{i=1}^{n}\sum_{l=1}^{n_0}\frac{b_{i\alpha_l}}{r_{i\alpha_l}} + \sum_{\substack{i,j=1\\ i<j}}^{n}\frac{c_{ij}}{r_{ij}} + \sum_{\substack{l,k=1\\ l<k}}^{n_0}\frac{c_{\alpha_l\alpha_k}}{r_{\alpha_l\alpha_k}}$$

or

$$V \equiv V_2 = -\sum_{i=0}^{p}\sum_{j=p+1}^{n}\frac{b_{ij}}{r_{ij}} + \sum_{\substack{i,j=0\\ i<j}}^{p}\frac{c_{ij}}{r_{ij}} + \sum_{\substack{i,j=p+1\\ i<j}}^{p+1,n}\frac{c_{ij}}{r_{ij}}$$

b and c -- nonnegative numbers; $0 \leq p < n$, n_0 -- arbitrary natural numbers

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$$r_{ij} = \sqrt{\sum_{\gamma=0}^{2} (x_{3i-\gamma} - x_{3j-\gamma})^2}, \quad r_{j\alpha_l} = \sqrt{\sum_{\gamma=0}^{2} (\alpha_{3l-\gamma} - x_{3i-\gamma})^2},$$

$\alpha_{3l-\gamma}$ ($\gamma=0,1,2$; $l = 1,\ldots, n_o$) -- arbitrary real numbers.

Let the operator H be defined on the set G_H of all finite functions twice continuously differentiable in R_n, let $\tilde{H}$ be the self-adjoint extension of H. Let the set of the isolated eigenvalues of $\tilde{H}$ with finite multiplicity be denoted as the discrete spectrum of $\tilde{H}$. Let the set of all other points of the spectrum be denoted as the limit spectrum. The point sets of the R_n on which $\psi = 0$ are denoted as nodes of a function ψ.

Theorem: Assume that the discrete spectrum of $\tilde{H}$ exists, and that

$$u_1, \ldots, u_k, \ldots \qquad (2)$$

be the complete (relative to the closed linear hull of all eigenfunctions of $\tilde{H}$) orthogonal normed system of the eigenfunctions of

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the discrete part of the spectrum of $\tilde{H}$; let (2) be ordered in the succession of increasing eigenvalues. Then the nodes of the function u_k can split up the space R_n into not more than k domains.

Corollary: The multiplicity of the smallest eigenvalue of the operator $\tilde{H}$ is = 1.

S. L. Sobolev is mentioned in the paper.

There are 6 Soviet-bloc and 4 non-Soviet-bloc references. The two references to English-language publications read as follows: E. G. Titchmarsh, Eigenfunction expansions associated with second-order differential equations, part II, Oxford, 1958; T. Kato, Comm. on pure and appl.math. 10, No. 2(1957)

SUBMITTED: June 5, 1959

Card 4/4

L 5048-66 EWT(d) IJP(c)

ACC NR: AP5021514 SOURCE CODE: UR/0038/65/029/004/0835/0860

AUTHORS: Zhislin, G. M.; Sigalov, A. G. 28 B

ORG: none

TITLE: On the spectrum of the energy operator in subspaces corresponding to irreducible representations of permutation groups for atoms with stationary nuclei

SOURCE: AN SSSR. Izvestiya. Seriya matematicheskaya, v. 29, no. 4, 1965, 835-860

TOPIC TAGS: quantum theory, Schroedinger equation, Coulomb interaction, group theory, electron energy level, differential operator, permutation, eigenvalue

ABSTRACT: The spectrum of the singular differential operator $H = T_n + V_n + W_n$ is studied, where T_n is the kinetic energy operator for n electrons, V_n is the Coulomb potential of the electrons in the field of an infinitely massive nucleus, and W_n is the sum of the pair Coulomb interaction operators for the electrons. H acts on the Hilbert space of complex-valued functions of 3n independent variables, possessing a definite permutation symmetry. Applying group-theoretical methods

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L 5048-66

ACC NR: AP5021514

of E. Wigner (Teoriya grupp i yeye prilozheniya k kvantovo-mekhanicheskoy teorii atomnykh spektrov, M., IL, 1961) and the theory of partial differential equations, the authors continue earlier investigations of the senior author (Issledovaniye spektra operatora Shredingera dlya sistemy mnogikh chastits, Tr. Mosk. matem. o-va, t. 9 (1960), 81-120) in spectral theory. The existence of an infinite sequence of proper values is established for every type of physically realizable permutation symmetry. If the symmetry is disregarded, H has an infinite set of isolated proper values converging to some $\mu \leq 0$. All points to the right of μ form the "limiting spectrum." Taking account of symmetry, it is found that all (except, possibly, a finite number of the eigenvalues of H) lie in the limiting spectrum if $n \geq 4$. The general results obtained are compared with previous work and various special cases. Orig. art. has: 130 formulas.

SUB CODE: MA, NP/ SUBM DATE: 15Jun64/ ORIG REF: 008/ OTH REF: 004

Card 2/2

ZHISLIN, G.M.; SIGALOV, A.G.

Mathematical theory of atomic spectra. Dokl. AN SSSR 163 no.2:323-325 Jl '65. (MIRA 18:7)

1. Nauchno-issledovatel'skiy radiofizicheskiy institut pri Gor'kovskom gosudarstvennom universitete im. N.I.Lobachevskogo.
Submitted January 15, 1965.

ZHISLIN, G.M.

Discreteness condition of the negative spectrum of the Schrödinger operator. Usp. mat. nauk 19 no.6:155-160 N-D '64 (MIRA 18:2)

JIJENKOVA, E.F. [Zhizhenkova, Ye.F.]; JISLIN, G.M. [Zhislin, G.M.]

Existence of the minimum of some quadratic functionals in an indefinite field. Analele mat 16 no.4:98-106 O-D '62.

ZHISLIN, G.M.; SIGALOV, A.G.

Mixed spectrum of certain multidimensional differential operators in quantum mechanics. Dokl. AN SSSR 157 no.6:1329-1331 Ag '64. (MIRA 17:9)

1. Predstavleno akademikom V.I. Smirnovym.

L 13489-66 EWT(d) IJP(c)

ACC NR: AP6001672 SOURCE CODE: UR/0038/65/029/006/1261/1272

AUTHORS: Zhislin, G. M.; Sigalov, A. G.

ORG: none

TITLE: Some mathematical problems in the theory of atomic spectra

SOURCE: AN SSSR. Izvestiya. Seriya matematicheskaya, v. 29, no. 6, 1965, 1261-1272

TOPIC TAGS: atomic spectrum, group theory, mathematic method, Hilbert space, Hamiltonian

ABSTRACT: The spectra of the energy operator for atoms is studied mathematically in subspaces corresponding to irreducible representations of direct products of commutation, rotation, and inversion groups. The symmetry properties of atomic spectra are based on the solution of the equation $H\psi = \lambda\psi$. The three symmetry groups of this equation are: the commutation group S_n; the rotation group R_3; and the inversion group $\mathfrak{W}$. If the indices of the irreducible representations of these groups are denoted by K, χ, ω respectively, the wave equation has the solution $\psi^{K\chi\omega}$. The existence of this equation is proved in the following analysis where the spectrum of the operator H is investigated in a subspace corresponding to the irreducible representations of the S_n group. The proof consists of four theorems. Theorem I proves that the inequality $\lambda_0(D_n^s) \leqslant \mu_{n-1}^s$

Card 1/3 UDC: 519.4

always exists; the necessary and sufficient conditions for $\lambda_0(D_n^\sigma)$ to be the point of discrete spectra for H_n^σ are

$$\overline{\lambda_0(D_n^\sigma)} < \mu_{n-1}^\sigma ,$$

and that the point $\lambda \geq \mu_{n-1}^\sigma$ forms the limiting spectrum of the H_n operator.

Theorem II shows that for an irreducible type of symmetry σ

$$\lambda_0^\sigma < \lambda_1^\sigma < \ldots < \lambda_{p-1}^\sigma \quad (p > 1)$$

the following inequality always holds $\lambda_p(D_n^\sigma) < \mu_{n-1}^\sigma$.

Using theorems I and II, it is then proved that

$$H_{n-1}\varphi^{(i)} = \mu\varphi^{(i)}, \quad i = 1, 2, \ldots, 2l+1$$

is true if $\mu = \mu_{n-1}^\sigma = \lambda_q(D_{n-1}^\sigma)$ is the characteristic value of the operator H_{n-1}, and that for $\sigma = (k,0,-1)$, $n = 2$, $\varphi^{k,0,-1} = 0$, then $\lambda_0^{k,0,+1} < \lambda_0^\sigma$ at $\sigma \neq (0, 0, +1)$.

Finally, for an arbitrary σ, if $\{\psi_m\} \in C_1^2(D_n^\sigma)$, then

$$\int_{R_n} |\psi_m|^2 d\Omega + \int_{R_n} |\operatorname{grad} \psi_m|^2 d\Omega < C \quad (m = 1, 2, \ldots),$$

$$\int_\Omega |\psi_m|^2 d\Omega \to 0 \quad (m \to \infty)$$

for any bounded domain $\Omega \subset R_n$, $\varliminf_{m\to\infty} L_n[\psi_m] \geq \mu_{n-1}^\sigma$.

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In the above, $\sigma = (k, \chi, \omega)$ is a Φ group representation connected with the $\bar{D}^{(k)}$ representation of the S_n^* groups. Orig. art. has: 30 equations.

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